On the predictability of spatiotemporal epidemics

Jeremy Nachison and Srini Venkatramanan

UVA BIOCOMPLEXITY INSTITUTE

Funded by:

VDH VIRGINIA DEPARTMENT OF HEALTH

NSF

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On the predictability of infectious disease outbreaks[1]:

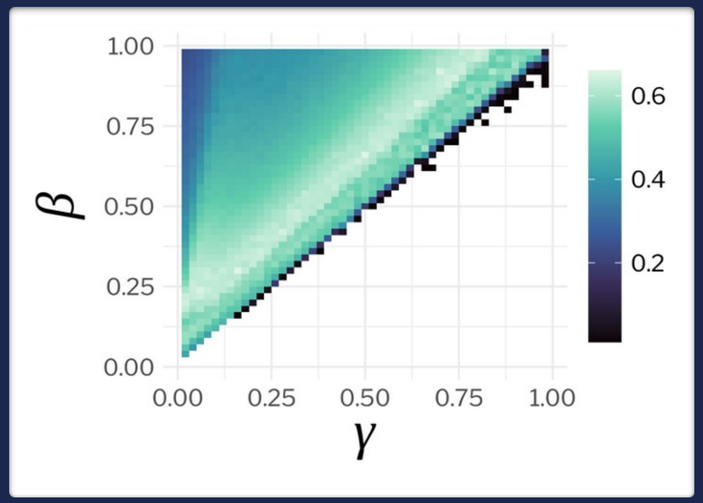
“Outbreaks should be predictable. However, as outbreaks spread…the system is driven through a space of diverse model structures, driving down predictability despite increasing time-series lengths”

1. Scarpino, S. V., & Petri, G. (2019). On the predictability of infectious disease outbreaks. Nature

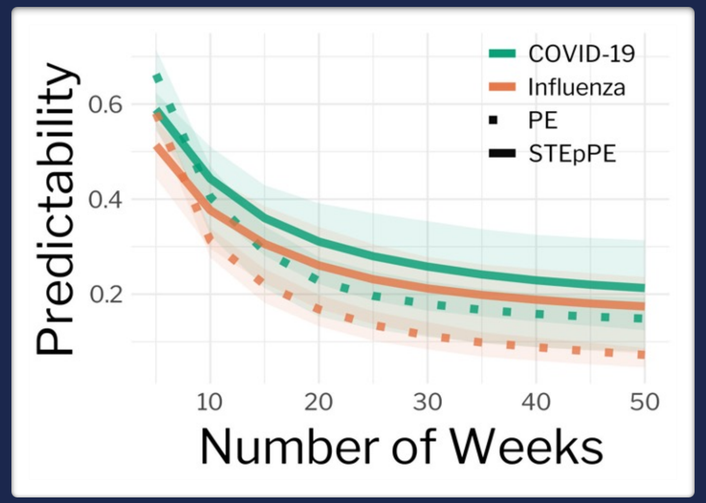
Question

- Can the notion of predictability be updated to account for spatiotemporal patterns?
- Can spatial information make epidemics more predictable and allow for longer forecast horizons?

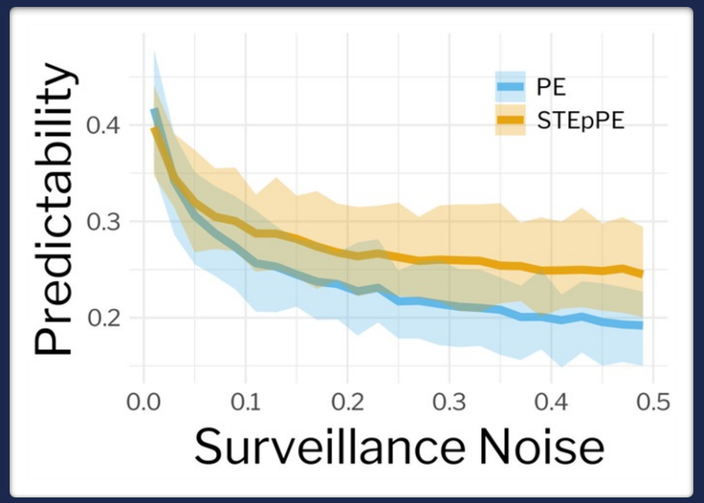
Results



Spatiotemporal entropy as a function of exposure rate, β, and recovery rate, γ.



Comparison of predictability with and without spatial information of Influenza and COVID-19.



Predictability through increasing surveillance noise with and without spatial information.

Findings

- **Predictability decreases more slowly for longer time series when spatial information is accounted for.**
- The incorporation of spatial information increases predictability of Influenza more than COVID-19.
    - Influenza is more predictable across space.
- The most unpredictable spatiotemporal epidemics are those with R_0 only slightly above the critical threshold

Thank you!